

TWO NEW SPECIES OF *METAJAPYX* (DIPLURA: JAPYGIDAE)  
FROM TENNESSEE

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*Abstract.*—Two new species of Japygidae from eastern Tennessee are described and illustrated. *Metajapyx heterocercus* n. sp. exhibits sexual dimorphism of the cerci and chaetotaxy of the tenth abdominal tergum, and *Metajapyx magnifimbriatus* n. sp. exhibits only 30 antennal segments. Both sexual dimorphism and the reduced number of antennal segments are new characters of the genus in the United States.

*Key Words:* Diplura, Japygidae, *Metajapyx*, taxonomy

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The genus *Metajapyx* Silvestri is represented in North America by eight eastern species (Smith and Bolton 1964). Recently, Rathman et al. (1988) illustrated a japygid from eastern Washington State as a *Metajapyx* sp.; some generic criteria for the genus *Metajapyx* were not reported for those specimens and therefore, further study is required to determine their generic placement.

Although two species of *Metajapyx* are quite widespread and frequently encountered (*M. subterraneus* [Packard] and *M. steevesi* Smith and Bolton), the other six species are locally distributed and rarely encountered. During intensive collection of *Metajapyx* spp. in the eastern United States for the purpose of revisionary studies we found two new *Metajapyx* species from eastern Tennessee. The objective of this paper is to describe and illustrate these new species.

#### MATERIALS AND METHODS

All specimens were cleared and stained in Essig's Aphid Fluid (Wilky 1962) and

double stain (1 part 5% aqueous lignin pink and 5% aqueous acid fuchsin to 10 parts of Essig's Aphid Fluid), then mounted in polyvinyl alcohol-lactophenol to further clear and expand the specimens, and dried in an oven (60°C) for two days. Measurements and illustrations were made with an ocular micrometer and a Nikon phase-contrast microscope equipped with a drawing tube or a Unitron stereo microscope. Body length measurements were made from the basal articulation of the antennae to the apex of the cerci. Measurements are presented as a mean followed in parentheses by the range.

Because the distinctions among certain taxonomic characters used to describe Japygidae are sometimes vague it may be helpful to define the more salient of these. The following definitions are those of Smith (1962): M = larger macrosetae of the body set in reinforced setal sockets, so as to move in a plane parallel to the body; m = medium-sized sub-macrosetae usually set in simple setal sockets; Microsetae = minute setae visible only under high magnification, always set in simple setal sockets; Friction

setae = a type of microseta with large sockets that occur in groups where the body integument folds or moves upon itself; Calcar setae = two setae at the ventral apex of a tibia which may be thicker or more robust, but no longer than other tibial setae; Apotome = the anterior sclerite of an abdominal sternum. For a more complete treatise of japygid terminology one should refer to Smith (1962), Pagés (1952), and Steinmann and Zombori (1984).

Another potentially important taxonomic character of japygids is cercal chaetotaxy. This character has been either ignored or used only sparingly in japygid taxonomy, yet it appears to be useful at the generic and specific levels. In this paper we propose a new scheme to describe the cercal chaetotaxy of the genus *Metajapyx*. The cercal setae are arranged into four general categories: the lateral setae (L), the dorsal setae (D), the ventral setae (V), and the postdental margin setae (P). Within each group, setae are numbered from proximal to apical, and given relative size descriptions (long, short or minute). In this paper cercal chaetotaxy is used to help distinguish closely related species.

*Metajapyx heterocercus*

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(Figs. 1a–f, 2a–d; Table 1)

Females.—Body length 12.1 (9.3–14.5) mm. Entire body and head yellowish-white, except for median sclerotized area at apex of epicranial and postoccipital sutures, and tergites VI through X, which are progressively more sclerotized posteriorly. Cerci heavily sclerotized.

*Antennae*: Thirty-two segmented and heavily setose, setae arranged in two irregular whorls, the basal whorl alternating as simple and hooked setae on segments 7 to 31 (Fig. 1a); terminal segment with 6 placoid sensilla arranged with 2 in basal whorl, 4 in apical whorl; lateral proliferation of setae occurring on segments 15 to 19; tri-

chobothria present on segments 4–6 in a 3,5,5 pattern and nearly as long as longest seta on segment.

*Head*: Numerous M, m, and microsetae; admental plate with 35+35 (29–42) m + microsetae; prementum with 27+27 (30–43) m + microsetae, most restricted to anterior half of sclerite; postmentum 1+1M, 1+1m, and 19+19 (17–20) scattered microsetae; submentum 1+1M, 4+4m, and 10+10 (8–12) scattered microsetae. Labial palp conical with one or two apical sensory cones and 11+11 (10–12) setae, the longest slightly longer than palpus. Terminal segment of maxillary palpus with 22 (20–27) setae, the longest as long as the segment; galea with 3 (3–4) external setae in a row, thumb of galea sclerotized, with 3 long sensory cones and 9 (6–11) short sensory cones; lacinia falciform and heavily sclerotized, all five laminae pectinate (Table 1), with a small basal spur between laminae III and IV.

*Thorax*: Pronotum 5+5M, 5+5m, and scattered microsetae; prescutum 1+1M and posteromedian and posterolateral groups of friction setae; mesonotum 6+6M, 7+7m, and scattered microsetae (Fig. 1b); prescutum 1+1M; posteromedian and lateral margin with friction setae; metanotum 5+5M, 5+5m, and scattered microsetae.

*Legs*: Pro-, meso-, and metacoxae each with a row of friction setae near apex of segment; dorsal base of trochanter with a circular group of friction setae; dorsal apex of femur with a row of 4 long setae; ventral apex of tibia with 2 calcar setae, one much longer than the other; tarsus with two ventral rows of 4–6 large setae becoming more robust distally. Additional setae on all segments scattered, most restricted to distal  $\frac{2}{3}$  of segment. Empodium minute on protarsus and becoming progressively larger on meso- and metatarsi, metatarsal empodium subequal to pretarsus.

*Abdomen*: Prescutum 1+1M and scattered friction setae; scutum 1+1M and scattered friction setae. Tergite II 3+3M, 2+2m, and scattered microsetae; anteromedian pair

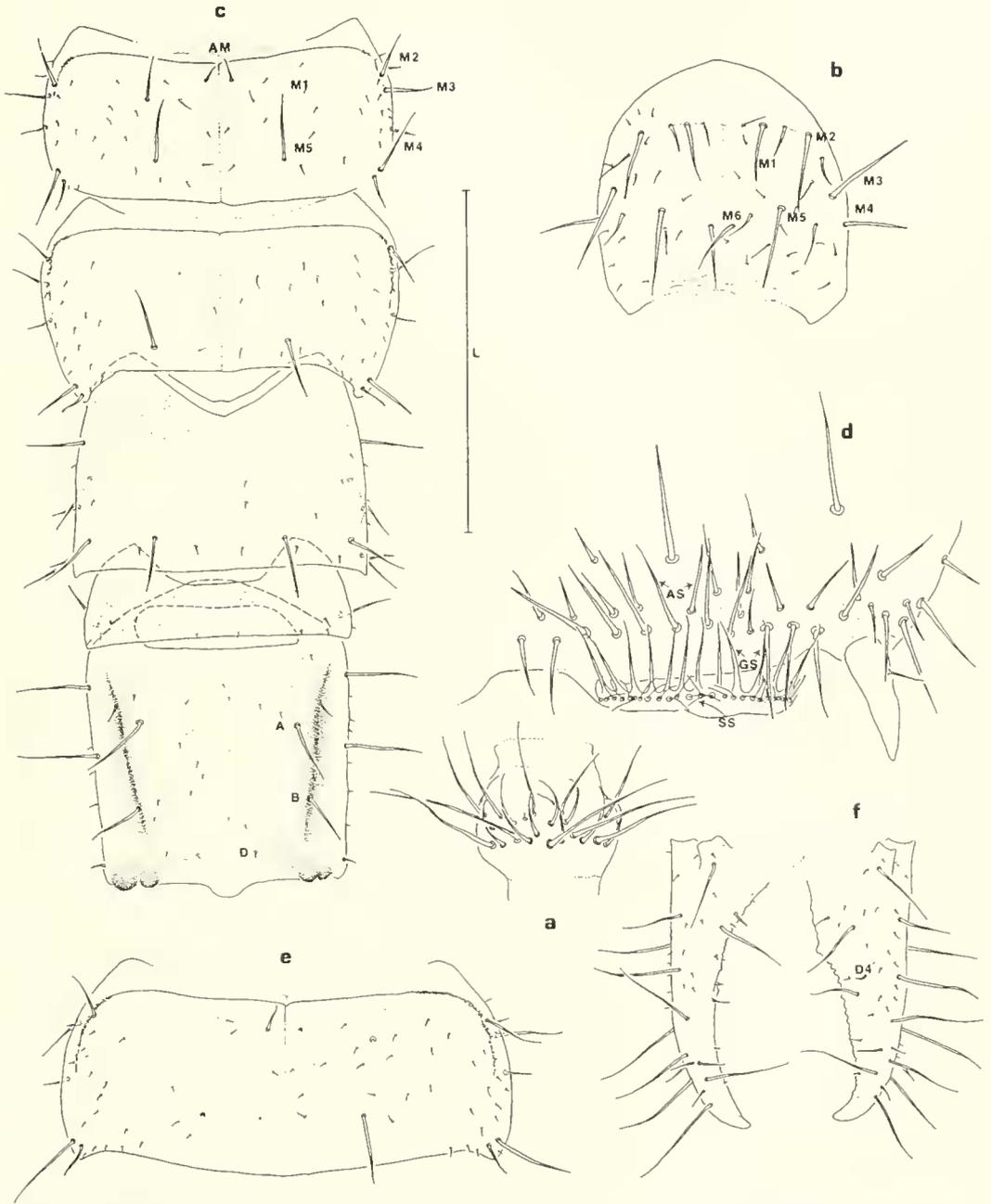


Fig. 1a-f. *Metajapyx heterocercus*. a, 14th antennal segment, L = 0.25 mm. b, Mesothorax, L = 1.0 mm. c, Tergites VI-X, L = 1.0 mm. d, 1st abdominal sternum, L = 0.25 mm. e, Tergite VI of male, L = 1.0 mm. f, Cerci of male, L = 1.0 mm. Terms: AM, anteromedian pair of setae; M, macroseta; AS, antecedent setae; GS, glandular setae; SS, sensory setae.

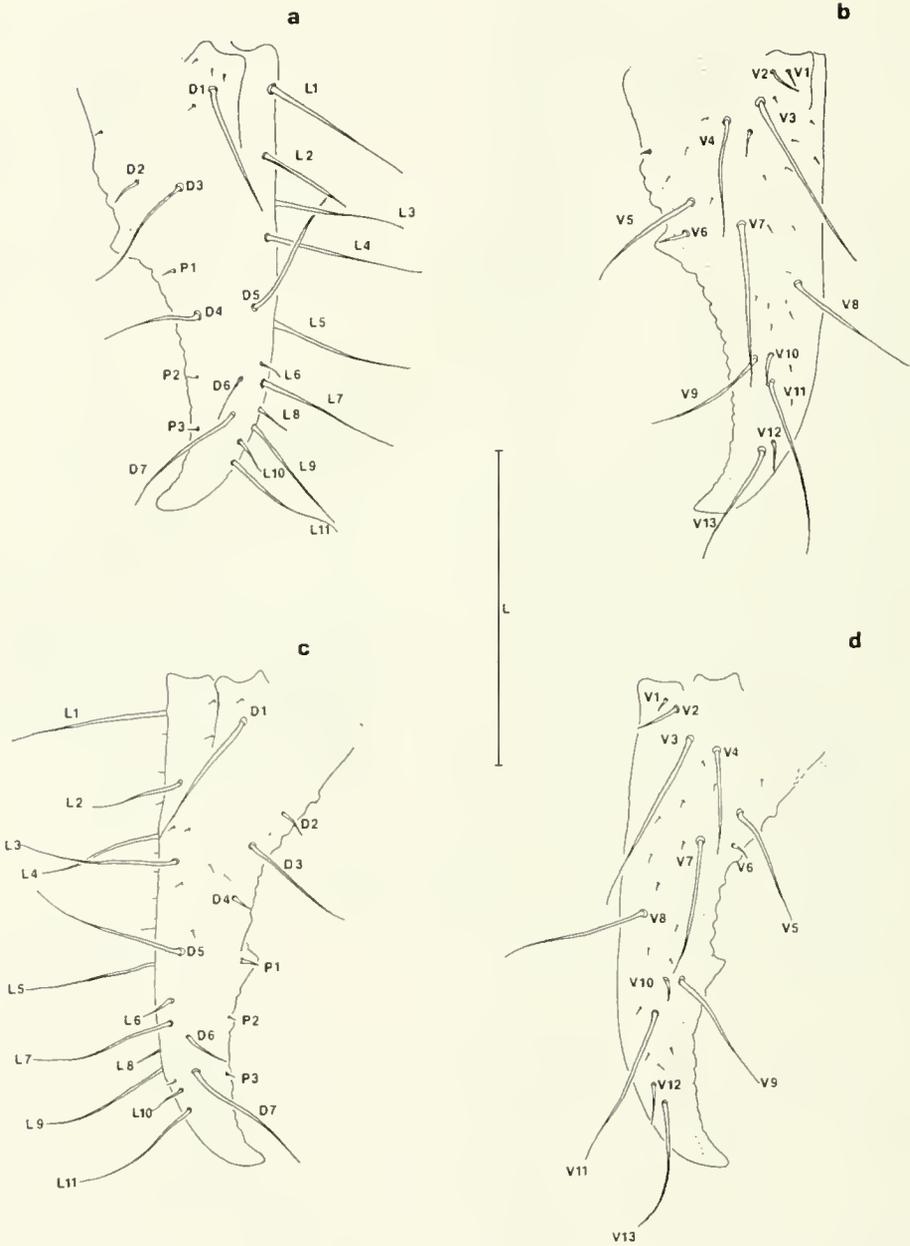


Fig. 2a-d. Chaetotaxy of female *Metajapyx heterocercus* cerci. a, Right dorsal view. b, Right ventral view. c, Left dorsal view. d, Left ventral view. L = 0.5 mm. Terms: D, dorsal setae; L, lateral setae; P, postdental margin stae; V, ventral setae.

of large setae progressively smaller on tergites III-VI and absent on tergite VII. Tergites III-V 5+5M, 2+2m, and scattered microsetae; tergite VI with M1 usually ab-

sent and posterolateral margins rounded, tergite VII with M1 always absent and posterolateral angles projected to the rear as blunt points (Fig. 1c). Tergite VIII 2+2M

Table 1. Mean number and range of laminal teeth in *Metajapyx heterocercus* and *Metajapyx magnifimbriatus*.

Lamina	Mean (Range)	
	<i>M. heterocercus</i>	<i>M. magnifimbriatus</i>
I	13 (11–14)	10 (10–11)
II	26 (24–29)	23 (21–24)
III	16 (14–18)	10 (9–11)
IV	17 (16–19)	14 (13–15)
V	14 (13–15)	13 (12–13)

and a few scattered microsetae; tergite IX 1+1M and a few scattered microsetae; plurae meeting in mid-ventral line, 2+2M and a few scattered microsetae. Tergite X with macrosetae A and B long, C absent, D minute or absent (Fig. 1c). Carinae distinct and nearly parallel; pygidium prominent and rounded.

Sternite I apotome 3+3m alternating with microsetae; sternite I 12+12M in four irregular transverse rows, scattered microsetae, and a group of two large posterolateral setae; antecedent setae 36+36 (29–39) and simple, in two irregular transverse rows, becoming sparse mesally; lateral subcoxal organs protruding from sternite, with 18+18 (12–23) glandular setae broad basally and gradually tapering apically, nearly as long as antecedent setae; 27+27 (21–38) hairlike sensory setae set in large setal sockets, about half as long as glandular setae (Fig. 1d); median glandular organ protruding, with 11 (8–14) contiguous disculi. Sternites II to VII 16+16M in transverse rows, 2+2m, and scattered microsetae; sternite VIII 7+7M and scattered microsetae.

*Genitalia*: Papillary area with groups of 11+11 (9–14) sensory pegs; anterior lobes with 4+4 (3–5) apical sensory pegs; posterior lobes with 4+4 (3–4) apical sensory pegs. Ventral carinae of segment X distinct with 10+10M and scattered microsetae.

*Cerci*: Right arm prepedal margin uniserrate with 4 (4–5) denticles, median tooth large and slightly rounded, postpedal margin crenate; dorsal (D) surface with 7 setae,

right lateral margin (L) with 11 setae, postpedal margin (P) with 3 minute setae, and ventral (V) surface with 13 setae: D1 long, D2 short, D3–5 long, D6 short, and D7 long, L1–5 long, L6–11 alternating short with long; V1–2 short, V3–5 long, V6 short, V7–9 long, V10 short, V11–13 alternating long with short (Fig. 2a, b). Left arm prepedal margin biserrate with 9 (9–10) denticles in dorsal row and 9 (8–11) denticles in ventral row; median tooth large and slightly rounded, postpedal margin crenate. Dorsal surface with the same number of setae as the right arm and L and P setal patterns same as right arm; D1–7 alternating long and short, V1 minute, V2 medium, V3–5 long, V6 short, V7–9 long, V10–13 alternating short and long (Fig. 2c, d).

Males.—Resembling females except tergite V with M1 sometimes absent, tergite VI with M1 usually absent and posterolateral margins usually projected back into rounded points (Fig. 1e), tergite X with A and C absent, B long, D minute or absent. Sternite I antecedent setae more numerous; slightly fewer glandular and sensory setae. Genital papillae conical, with 2+2 (1–3) apical sensory pegs and numerous short setae mesally and long setae distally; genital opening with numerous short marginal setae becoming progressively longer distally.

*Cerci*: Right arm prepedal margin uniserrate with four denticles, median tooth large, rounded, occasionally projected posteriorly, postpedal margin crenate, slightly falcate (Fig. 1f). Chaetotaxy similar to female except L1 and V1 absent, and a short extra dorsal seta (D4'). Left arm similar to female except median tooth minute or absent, L1 absent, L6 long, L7 short; D4 minute, V1 and V6–8 absent.

Type material.—Holotype male and allotype female: Tennessee, Knox County, Cherokee Trail, 3.2 km south of the University of Tennessee (elevation ca. 650 meters), 24-X-1988; M. A. Muegge. Paratypes (4 males, 4 females): Same data as holotype and allotype. Habitat.—All specimens were

found 5–10 cm deep in moist gravelly clay soil or under rocks in a beech-maple forest. The holotype, allotype and two paratypes (1 male, 1 female) are deposited in the United States National Museum (USNM). The other paratypes (3 males, 3 females) are deposited in the Apterygote Section of the University of Tennessee Entomology Museum, Knoxville, TN. Etymology.—Greek *hetero* (“different”), Greek *cercus* (“tail”), which refers to the sexually dimorphic differences in the cerci.

**Diagnosis.**—Within the North American *Metajapyx* spp., female *M. heterocercus* appear to be most closely related to *M. steevesi*. Females of both species are nearly identical in form and chaetotaxy; however, *M. heterocercus* possess only simple antecedent setae, while *M. steevesi* usually possess at least a few fimbriate setae. Additionally, *M. heterocercus* differs by the chaetotaxy of tergite X (seta C absent and B bisects tergite X at  $\frac{2}{3}$  its length rather than  $\frac{1}{2}$  its length as in *M. steevesi*), and both cerci lack dorsal setae D1' and usually D7'. Male *M. heterocercus* are taxonomically similar to *M. folsomi* Silvestri, yet *M. heterocercus* males are distinguished by possessing only a few simple antecedent setae that are generally uniform in size, tergite VI with the anteromedian pair of setae always present, and the median tooth of the left cercus minute or absent.

*Metajapyx magnifimbriatus*

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(Figs. 3a–f, 4a–e; Table 1)

**Females.**—Body length 9.2 (7.4–10.9) mm; all aspects of this species are similar to *M. heterocercus* unless otherwise noted.

**Head:** 30 antennal segments, terminal segment with 2 whorls each with 4 placoid sensilla; posterolateral proliferation of setae occurring on segments 13–17. Labial palpus with 10+10 setae; maxillary palpus with

18+18 (15–21) setae on terminal segment; all laminae of lacinia pectinate (Table 1).

**Thorax:** Mesonotum with 5+5M, 6+6m, and scattered microsetae (Fig. 3a).

**Abdomen:** Tergites VI and VII with M1 and AM always present, posterolateral margin of VI rectangular, VII projected back into sharp points, the latter occasionally falcate; tergite X setae A, B and C large, D minute or absent (Fig. 3b). Sternite I with 13+13M (12–14) in three transverse rows and scattered microsetae; antecedent setae 30+30 (29–32); subcoxal organs with 7+7 (4–10) glandular and 18+18 (15–23) sensory setae (Fig. 3c, d); median glandular organ protruding and with 11 (9–13) contiguous disculi; sternites II–VII with 17+17M in four transverse rows. Genital papillae with 8+8 (5–10) sensory pegs; anterior and posterior lobes with 3+3 sensory pegs.

**Cerci:** Right arm predental margin biserrate with 1:2, 2:2 or 2:3 denticles; median tooth medium and sharply pointed; postdental margin smooth to slightly crenulate and strongly falcate; chaetotaxy similar to *M. heterocercus* n. sp. except extra L4' short, D1' and D3' long, and V7' long (Fig. 4a, b). Left arm predental margin biserrate with 5 (4–5) dorsal toothlets and 7 (6–7) ventral denticles; median tooth small and sharply pointed; postdental margin smooth to slightly crenulate and sharply falcate; chaetotaxy similar to *M. heterocercus* n. sp. except extra L4' short, D1' long, D3' long, and V7' long (Fig. 4c, d).

**Males.**—Body length 9.4 (9.3–9.4) mm. Similar to female except: tergite VI with M1 occasionally absent and posterolateral margins usually projected back into sharp points; tergite VII with M1 always absent (Fig. 3e); sternite I with numerous fimbriate antecedent setae restricted to posterior third of sclerite becoming sparse mesally, and a few simple antecedent setae in an irregular transverse row anterior of subcoxal organs becoming sparse mesally (Fig. 3f). Genital papillae conical, with 2+2 apical sensory

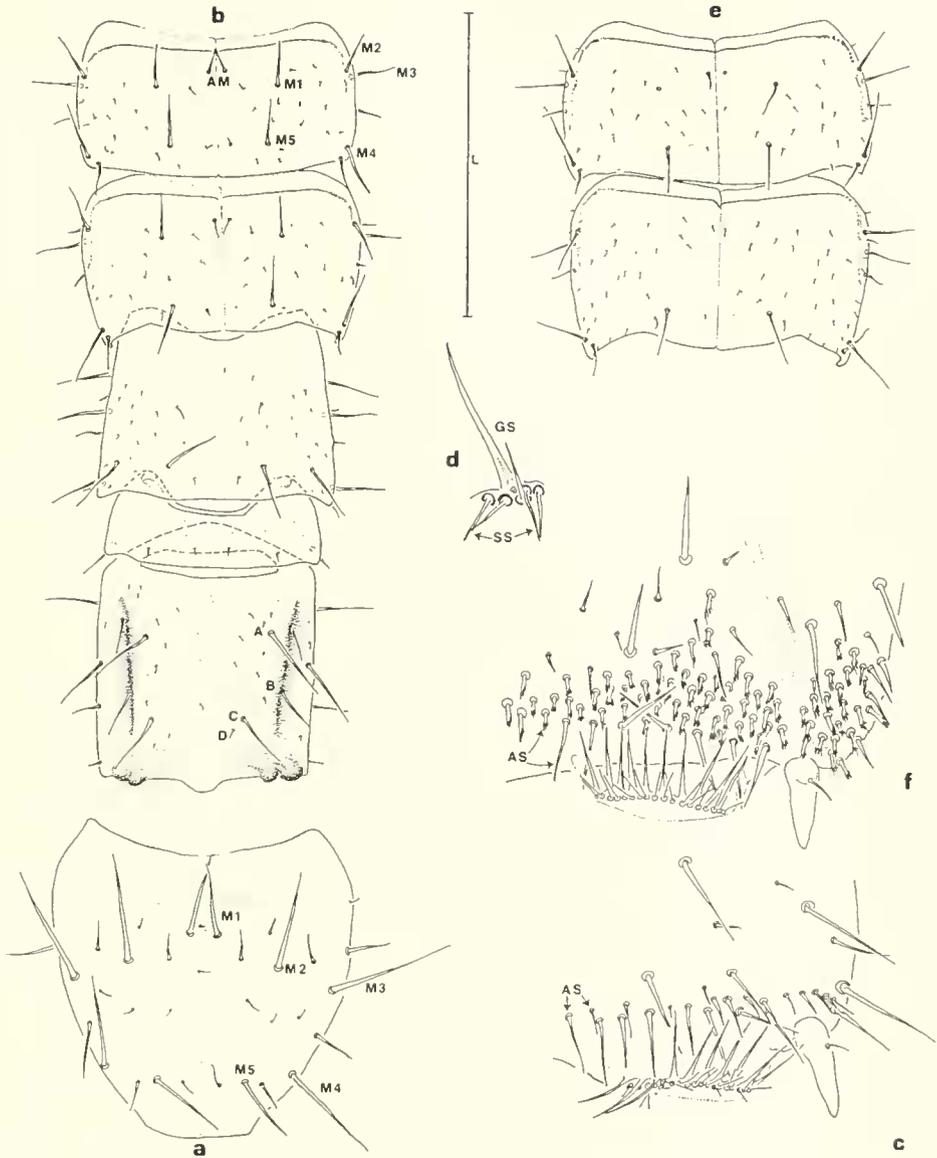


Fig. 3a-f. *Metajapyx magnifimbriatus*. a, Mesothorax, L = 0.5 mm. b, Tergites VI-X, L = 1.0 mm. c, 1st abdominal sternite of female, L = 0.25 mm. d, Sensory and glanular setae of lateral subcoxal organ, L = 0.1 mm. e, Tergites VI-VII of male, L = 1.0 mm. f, 1st abdominal sternite of male, L = 0.25 mm. Terms: AM, anteromedian pair of setae; M, macroseta; AS, antecedent setae; GS, glandular setae; SS, sensory setae.

pegs and numerous short setae mesally and long setae distally; genital opening with numerous minute marginal setae becoming longer distally.

*Cerci*: Right arm with predental margin

biserrate with 1:2 or 1:3 denticles, chaetotaxy similar to female except L1 and L4' absent, D2 and D4 minute, V1 and V2 absent, V3 and V5 medium, V7 and V7' absent; left arm predental margin biserrate with

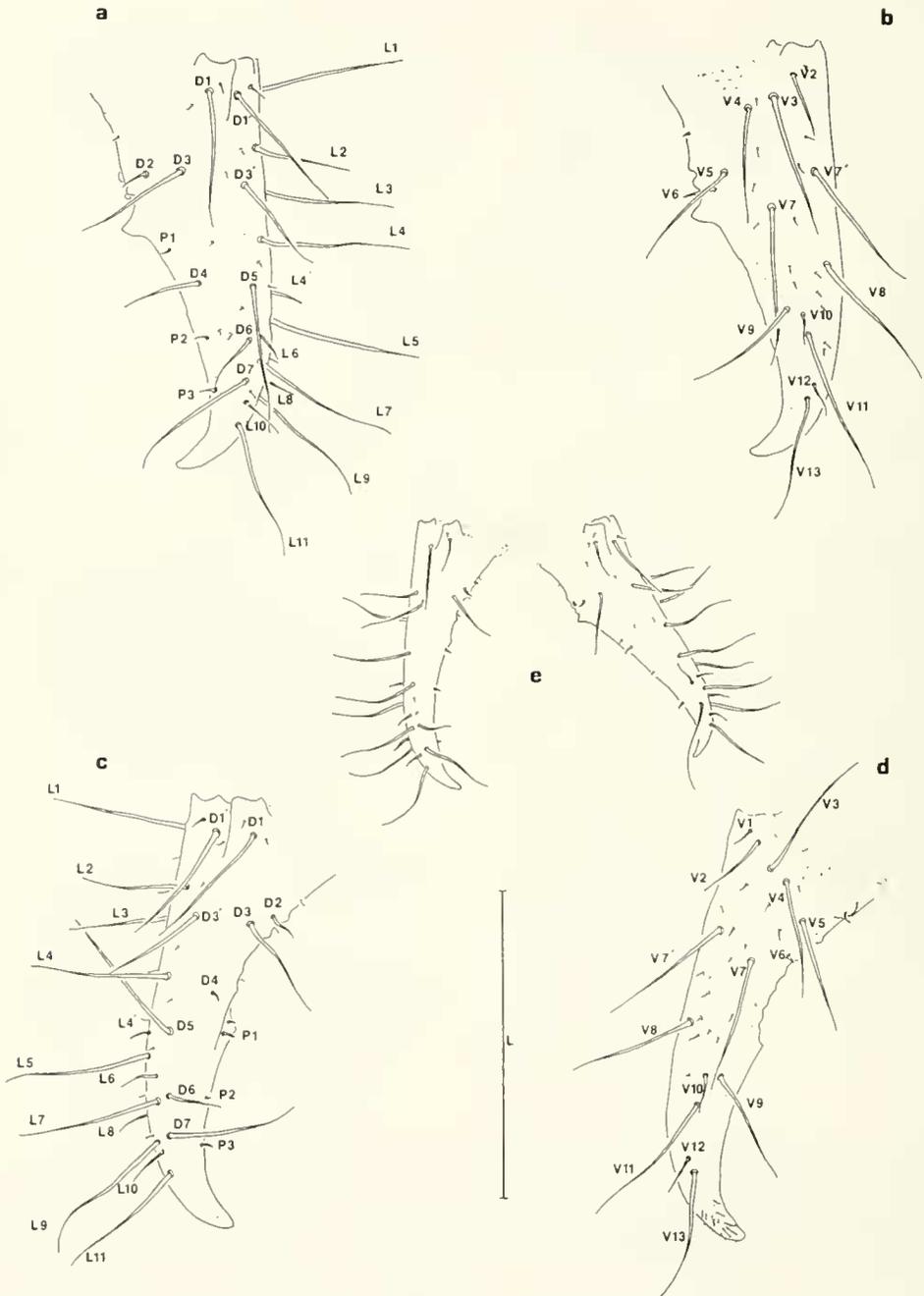


Fig. 4a-e. Chaetotaxy of male and female *Metajapyx magnifimbriatus*. a, Right dorsal view, L = 0.5 mm. b, Right ventral view, L = 0.5 mm. c, Left dorsal view, L = 0.5 mm. d, Left ventral view, L = 0.5 mm. e, Dorsal view of male cerci, L = 1.0 mm. Terms: D, dorsal setae; L, lateral setae; P, postdorsal margin setae; V, ventral setae.

5 (5–6) dorsal toothlets and 5 (4–6) ventral toothlets, median tooth minute and sharply pointed; chaetotaxy similar to female except L1 absent, D1 short, V1–2 absent, V3 medium, V5 short, and V6–7 absent (Fig. 4e).

Type material.—Holotype male and allotype female: Tennessee, Knox County, Cherokee Trail, 3.2 km south of the University of Tennessee (elevation ca. 650 meters), 24-X-1988; M. A. Muegge. Paratypes (2 males, 3 females): Same data as holotype and allotype. Habitat.—All specimens were found 15–30 cm deep in moist clay soil in a beech-maple forest. The holotype, allotype and two paratypes (1 male, 1 female) are deposited in the United States National Museum (USNM). The remaining paratypes (1 male, 2 females) are deposited in the Apterygote Section of the University of Tennessee Entomology Museum, Knoxville, TN. Etymology.—Latin *magni* (“great”), Latin *fimbriatus* (“fringed”), which refers to the numerous fringed antecedent setae of the male.

Diagnosis.—*Metajapyx magnifimbriatus* most closely resembles *M. multidentis* (Cook)

and *M. propinguus* (Silvestri), but may be easily distinguished from the latter two species by the following characters: 30 antennal segments, anteromedian pair of setae always present on tergites VI and VII, seta M1 always present on tergites VI and VII of female (M1 absent on VII and sometimes on VI for male), median tooth of cerci small and sharply pointed, and postdental margins of cerci smooth.

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